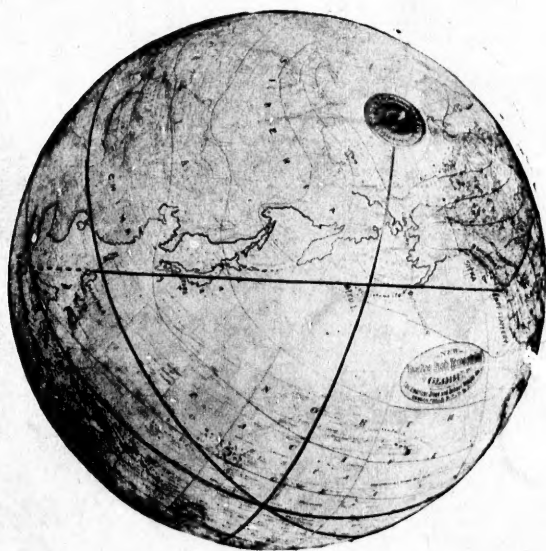
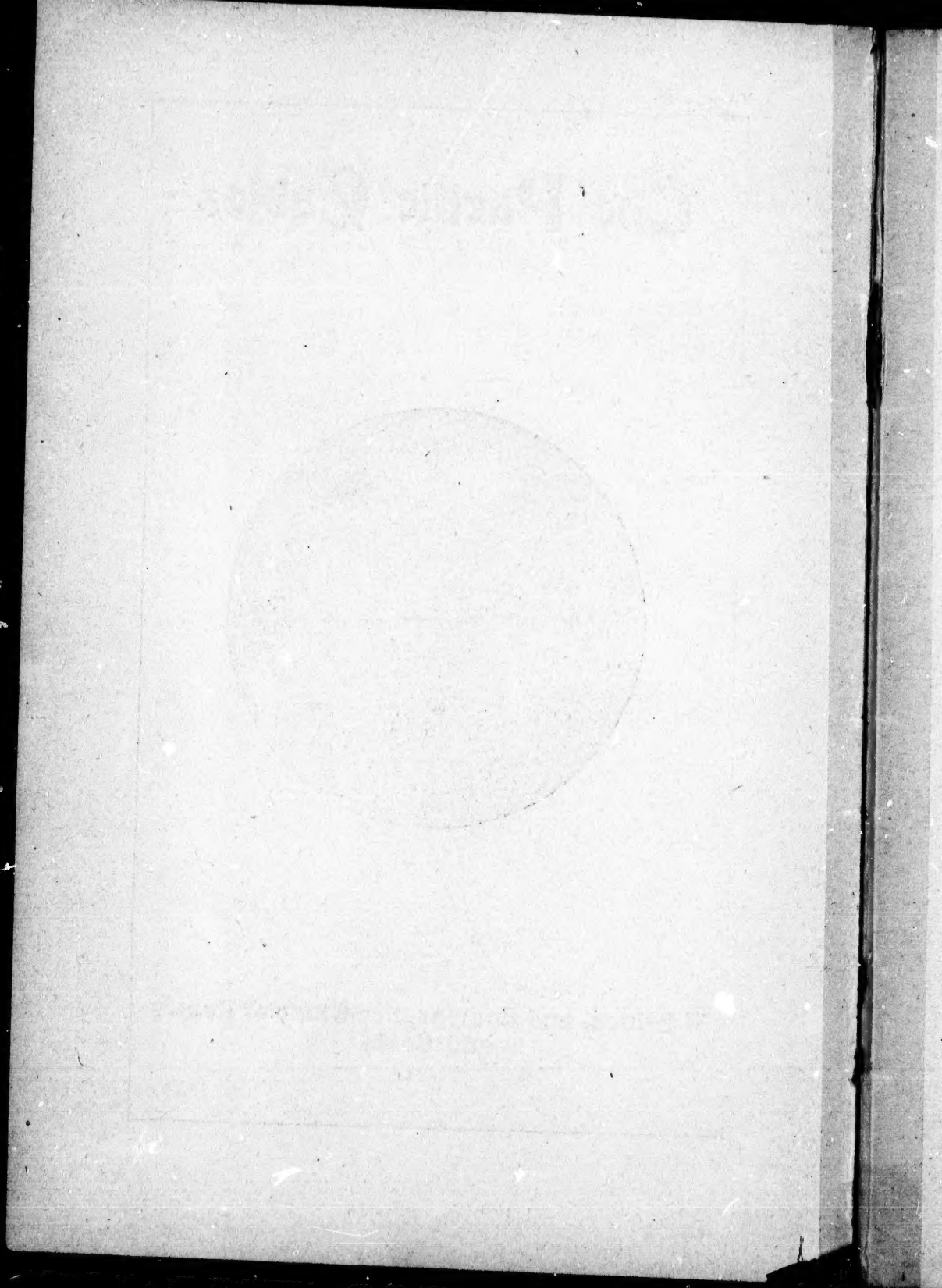


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The Pacific Cables



**A Critical and Comparative Study of Routes
and Costs**



The Pacific Cables

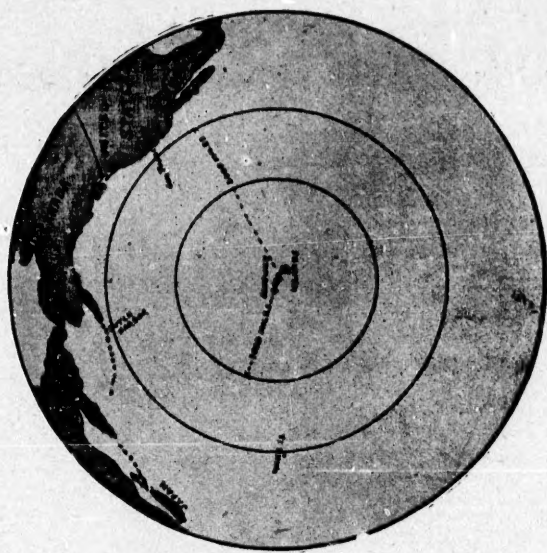
**A Critical and Comparative Study of Routes
and Costs**

BY

Harrington Emersor. M. A., M. E.
Member A. S. M. E.

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Hawaii, Surrounded by Uninhabited Ocean.



Dutch Harbor as Central Port in the North Pacific Ocean.

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Preface.

The Pacific cable is not a local enterprise. It will employ few men and buy no supplies. It matters not to New York or London that the many cables which carry their messages to and from each other are landed on the wild coasts of Ireland, Newfoundland, Nova Scotia, etc., and similarly, it cannot matter to the people of the United States and of the Pacific states in particular, on what storm-beaten spot of the great Pacific the lonely cable hut is erected, as from it, wherever located, messages will be instantaneously flashed to San Francisco, to Portland, to Seattle and Tacoma, to Victoria and Vancouver, and from these centers relayed to every part of the world. But it does matter enormously that the Pacific cable route selected shall be the best possible one, along which the line can be easily laid, readily maintained and operated with a high speed of transmission and with low tolls.

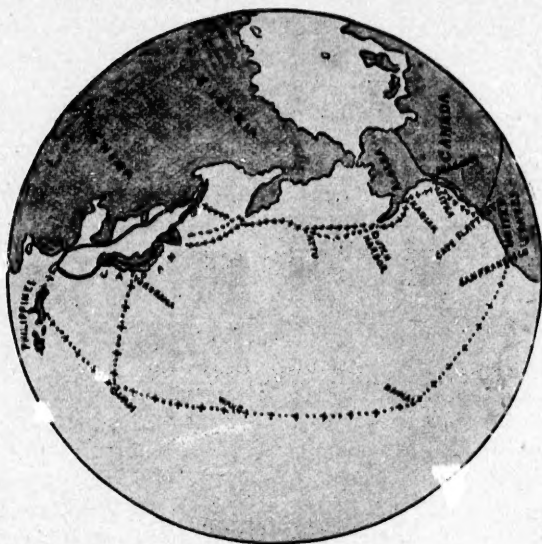
A cable from San Francisco to Hawaii has long been wanted, and should be subsidized or laid by the government, but the best cable route across the Pacific is not by way of Hawaii, because such a route will be twice as long and the cable cost three to four times as much as along a safer, shorter, better route lying further north, which has also the three additional advantages of connecting with the United States the 600,000 square miles of Alaska, so rapidly increasing in population and importance, of having its stations along the weather track, thus permitting forecasts of inestimable value to the whole United States to be made with extreme accuracy nearly a week sooner than at present, of being the shortest, best and cheapest line from Western Europe to Eastern Asia.

The whole distance from the United States to the Philippines by way of Japan can be covered by double lines—a guarantee against interruption of traffic—a separate line can be laid from San Francisco to Hawaii and a third line—if necessary—from Manila to Guam for *two thirds* of the estimated cost of the single cable line to Asia via Hawaii. A single line of the highest efficiency and standard can be laid to the Japanese-Russian boundary, thence with many manifold connections to Manila, for *one third to one fourth* of the cost of a single line via Hawaii.

This whole subject can be best and most accurately illustrated by stretching on a globe threads serving as miniature cables, between the various terminals, and then measuring, accurately determine courses and distances, which it is impossible to do on any ordinary map. The smaller illustrations have, therefore, been reproduced from photographs of a globe. The other diagrams and maps graphically compare the proposed routes.

This pamphlet is a revised abridgement of an article appearing in the November, 1899, number of the **ENGINEERING MAGAZINE**.

HARRINGTON EMERSON,
416 W. Cheltenham Avenue, Philadelphia Pa.



The Two Routes, Direct and Roundabout.

The Proposed Pacific Cables

By Harrington Emerson.

OCEAN cables are commercial enterprises to facilitate communication between friendly countries. Every one of the sixteen North Atlantic cables was laid to this end. It is folly to make an improbable war the governing condition for a new cable, especially

The rapidly advancing development of the Far East demands the speedy completion of the world's electrical girdle. England's road to China across her vast North American colonies, and America's route to her new Pacific possessions, must be paralleled by a Trans-Pacific cable. But it must be a practicable, commercially valuable line—not a national feticch. Mr. Emerson is finishing a thorough study of the entire question, in which he has had invaluable aid and exceptional facilities afforded by officials and by the great telegraph companies. His conclusions, imparted in this paper, are of particular interest and importance at this juncture to the English-speaking world on both sides of the Atlantic. The Editors of the "Engineering Magazine."

as there is nothing so vulnerable as a national cable, nothing so safe as a neutral or international cable.

Notwithstanding strenuous efforts, the United States was not able to interrupt cable communication with Cuba, because there were several cables to neutral shores. Admiral Dewey found no difficulty in severing the Spanish end of the Hongkong-Manila cable, but he was not able to interrupt communication brought by boat from the neighboring neutral shores to which a British cable runs.

If Great Britain should become involved in a European war, her communication to Asia would be much safer via American and Japanese landings than via small islands in the Pacific, the route selected for the *all-British* cable from Vancouver to New Zealand. Nothing is easier than to cut the Vancouver end of such a cable, not only cut it, but by removing a piece damage it beyond the ability of any cable steamer to repair, and the Fuca Straits abound with desperate adventurers, opium and Chinamen smugglers, mining camp followers who, for a consideration from the agent of the power with which Great Britain were at war might cheerfully undertake to maintain such a cable in a permanent state of disability. In the words of Charles Bright, the great cable authority: "The only way to protect a cable is for a man-of-war of our own nationality to be always at the right spot to keep guard or intervene."

In time of war a national cable becomes at once, in its whole length, so much more frontier exceedingly vulnerable and impossible to defend against the most insignificant enemy.

The real prize in sight for a Trans-Pacific cable is not the transmission of war dispatches, but the Asiatic business which shall be briefly considered in comparison to European trade, in its actual volume and in its prospective growth.

The foreign trade of the United States with Europe, facilitated by thirteen cables and several more building, is between \$1,500,000,000 and \$2,000,000,000 annually. The total foreign commerce of Asia amounts to \$2,000,000,000, and it is helped by three cables from Bombay via Aden, one Persian Gulf line via Asia Minor, and one Russian overland route.

The north-eastern Asiatic trade amounts to \$656,000,000, of which the United States in 1897 had secured \$112,000,000, or about one-sixth. This business, with the densest population in the world back of it, is as naturally tributary to the United States and Canada as the trade of the Hawaiian Islands is tributary to San Francisco, which has secured 99.79 per cent. of the exports from, and 76.27 per cent. of the imports into, the islands. The possession of the Philippines by the United States, the development of Japan,

the awakening or partition of China, the completion of the Siberian Railroad (which will be finished in two years), will enlarge the trade of Asia to a volume commensurate with population, and North America should secure most of it. Mr. Herbert H. D. Peirce, first secretary of the United States embassy to Russia, calls this latter country, as opened by the new railroad, an immense field, far beyond anything realized by Americans, for the introduction of machinery and for an unlimited market of manufactured goods. Mr. John Barrett, formerly United States Minister to Siam, who has made a special study of Asiatic trade, gives the single island of Java, which is but little larger than the State of New York, an annual foreign trade of \$250,000,000; yet Java has only half the extent of fertile areas credited to the Philippines. He gives to Hongkong in 1897 a total of \$250,000,000, and to Singapore \$180,000,000, and for the Asiatic coast from Singapore to Vladivostok the mighty sum of one billion dollars and yet, he adds, the foreign trade of this wonderful Pacific-Asiatic coast line is only in the earliest stages of its development.

Elsewhere, urging the laying of a Pacific cable, he says that the tremendous monopoly of the present telegraphic connection between the far East and America is a great handicap to the development of trade with the United States, and that he has frequently heard merchants of all nations in Asiatic ports say that the cost, time and difficulties of cable connection with the United States work against the extension of American commerce.

With cable connection, Mr. Barrett estimates the probable increase of Philippine trade alone in the next fifteen years at 300 per cent. It is, therefore, within reason to estimate the growth of all the Asiatic trade at 50 per cent. in the next ten years, and if the proportion obtained by North America becomes 25 per cent. of the whole, there would be an increase in American business to \$600,000,000. This is a prize in the telegraph field that is worth securing by being first in the field, obtaining as many privileges and connections as possible, and reaping for years all the benefits of non-competitive business.

The difference in cost between long cables in deep seas far away, and short cables near manufacturing centers, is shown by the comparison of the reported price for the Denmark-Iceland cable and the estimates of the British Commission for the proposed British-Pacific cable. The distance from Denmark to Iceland via Scotland and the islands, is 900 miles, and the route lies through shallow northern oceans.

The contract price is 450,000 Kroners, of which the Althing of Iceland is to contribute 150,000 Kroners, and the Great Northern Telegraph Company of Copenhagen the balance of 300,000 Kroners.

This estimate, if correct, which is not probable, would have to be very greatly increased at the present time, owing to the recent rise in the price of all cable material.

The estimate for the Vancouver-Australian cable—a distance of 7,986 n. miles, with one long stretch of 3,561 miles—was £2,000,000, or \$1,220 per mile. In the one case a mere filament of copper and insulation is used, which is cheaply laid by a small steamer; in the other case the minimum proposed by Lord Kelvin is 552 lbs. of copper and 368 lbs. of gutta percha per mile. It is not a small item of expense to fit up a cable steamer that can carry 10,000 tons of cable and the necessary coal for a 3,500-mile trip. The annual maintenance cost of this long cable, exclusive of operating expense or interest, is put at \$350,000 annually. Owing to its one long stretch of 3,561 miles, this cable costs per mile many times the 900-mile Icelandic cable in two stretches. These are extreme examples, one, the cheapest long cable in the world; the other, the most expensive, except the proposed American cable via Hawaii.

ROUTES.

Three different routes are proposed for a Pacific cable. One of these, the *all-British* has already been mentioned. It is not an American-Asiatic cable across the Pacific, but a north and south cable through the Pacific, being further from Japan and China at New Zealand than at Vancouver. It is not a route that would be seriously considered as a commercial enterprise, but the sentiment *all-British* is being ingeniously put forward to coax subsidies from Great Britain and the colonies.

The other two projects are American, and both propose to establish communication with Japan and the Philippine islands. The merits and demerits of these two routes are to be considered in the light of cable practice, almost fifty years old, and with a record of 170,000 miles of deep-sea cable in successful operation. It is to be hoped no mistake will be made, and that Americans will not make themselves the laughing stock of the world's engineers by hastily and recklessly selecting the wrong route.

General Considerations

The experience of the past shows that a satisfactory and reliable cable is best laid in cold, quiet, moderately deep water with a sand or mud bottom, free from rocks and coral. The shorter the links between stations the better for rapid transmission, cheap construction, maintenance and repairs.

LENGTH.

The weight of both copper and insulation increases very rapidly with length. The British Post Office standard up to one thousand nauts (sea or geographical mile, 6080.27 feet, or 1.15 statute mile) for shallow water, is 107 lbs. of copper and 140 lbs. of gutta percha. For deeper, colder water, 1,000 fathoms, 100 lbs. of India rubber is sufficient. At 800 nauts a cable of this standard has a speed of eighty-five words a minute, because it is possible to use a Morse instrument with Brown Allan relay. At 1,130 nauts—too far for the Morse—it has a speed of about twenty-six words a minute. To increase speed on equal lengths, or to maintain speed on longer lengths, more copper must be used. A cable of 1,800 nauts requires about 470 lbs. of copper and 340 lbs. of gutta percha per naut for thirty-six words a minute. The long Atlantic cables take 650 to 660 lbs. of copper and 400 of gutta percha per naut for a speed of fifty words.

The estimate of Lord Kelvin for the all-British cable has already been given as 552 lbs. of copper and 368 lbs. of gutta percha per naut, and various experts put the speed of practical paying business at four to forty words a minute. Roughly, for a given number of words a cable three times the length takes six times as much copper; a cable four times the length eight times as much copper. Happily, cost can be kept down by increasing the copper and lessening insulation, the price of the latter being about eight times that of copper per pound.

Besides the objections on account of cost and electrical efficiency, length also increases the mechanical difficulties of carrying and laying cables, and in case of accident, however slight the flaw, the whole stretch is thrown out of service. Owing to one weak spot the first Atlantic cable lies abandoned in the ocean.

DEPTH.

Depths from 300 to 1,500 fathoms are desirable. Less depths subject the cable to injury from dragging anchors, currents and storms. Shore ends of cables are, on this account, always heavier and cost more. On the other hand, if a cable is laid in very deep water, the sheathing and armor must be heavier to resist the great weight when being paid out, and the pressure of the water is nearly 8,000 lbs. to the square inch in 3,000 fathoms. Internal flaws are more serious in depths at which it is difficult—often impossible—to effect repairs. It cost \$460,000 to repair one flaw in the French cable, and the second and third Atlantic cables are no longer repaired, but abandoned. If a deep cable is laid snugly along the bottom it cannot be lifted, but breaks in the grapple. If not snugly laid, there is waste in slack, usually 6 per cent. in shal-

low waters, rising to 10 per cent. at 1,500 fathoms, 15 per cent. at 2,000, and 20 per cent. or higher at 3,000 fathoms. Length and extreme depth are, therefore, both objectionable, increasing first cost, maintenance and repairs.

BOTTOMS

Bad bottoms are rock, submarine mountains and valleys, shallow anchorages and worst of all, coral. Cables may be destroyed by extreme pressure or strain, if not perfectly made; by fraying against rocks, by suspension across valleys, by being stretched too tightly down mountains, or the teredo may bore into them, or volcanic action break them. It is on account of coral, the depth and uneven bottom, that the Marconi system of wireless telegraphy has been proposed for communication between the Hawaiian islands in preference to submarine cables. It would seem to be only prudent to connect these islands with each other before the much more difficult task is attempted of connecting them with the distant mainland, just as England first laid cables to Ireland, France and Germany before attempting to lay them to the United States.

DISTANCES.

A great circle is the largest circle around the earth. The equator is a great circle, so are all the meridians. There is manifestly no route quite so short from one point on the equator to another east or west as along the equator, no route so short from one point on a meridian to another on the same meridian as one north or south along the meridian, both great circles.

It is shorter by way of the north pole from a point a few degrees north of the equator to a point on the other side of the globe also north of the equator, than it is around by the equator. A great circle can be constructed through any two points, and the arc of the great circle is the shortest possible distance between them. A great circle constructed from Panama to Singapore runs through Dutch Harbor, Alaska. All the Atlantic and Pacific steamers, all the Atlantic cables, follow great circles as closely as conditions will permit, but the two new Atlantic cables will diverge from this short course and be laid far to the south via the Azores, because there is no other way in which the long stretch from Ireland to Newfoundland can be broken into two shorter links, and, notwithstanding the increased cost and greater aggregate length, there will be gain in speed and economy.

The western cable builder is more fortunate than his Atlantic forerunner, because in the Pacific the short great-circle route is also the route of shortest links. It does not run through the wastes of the Pacific, but follows closely the British and United States north

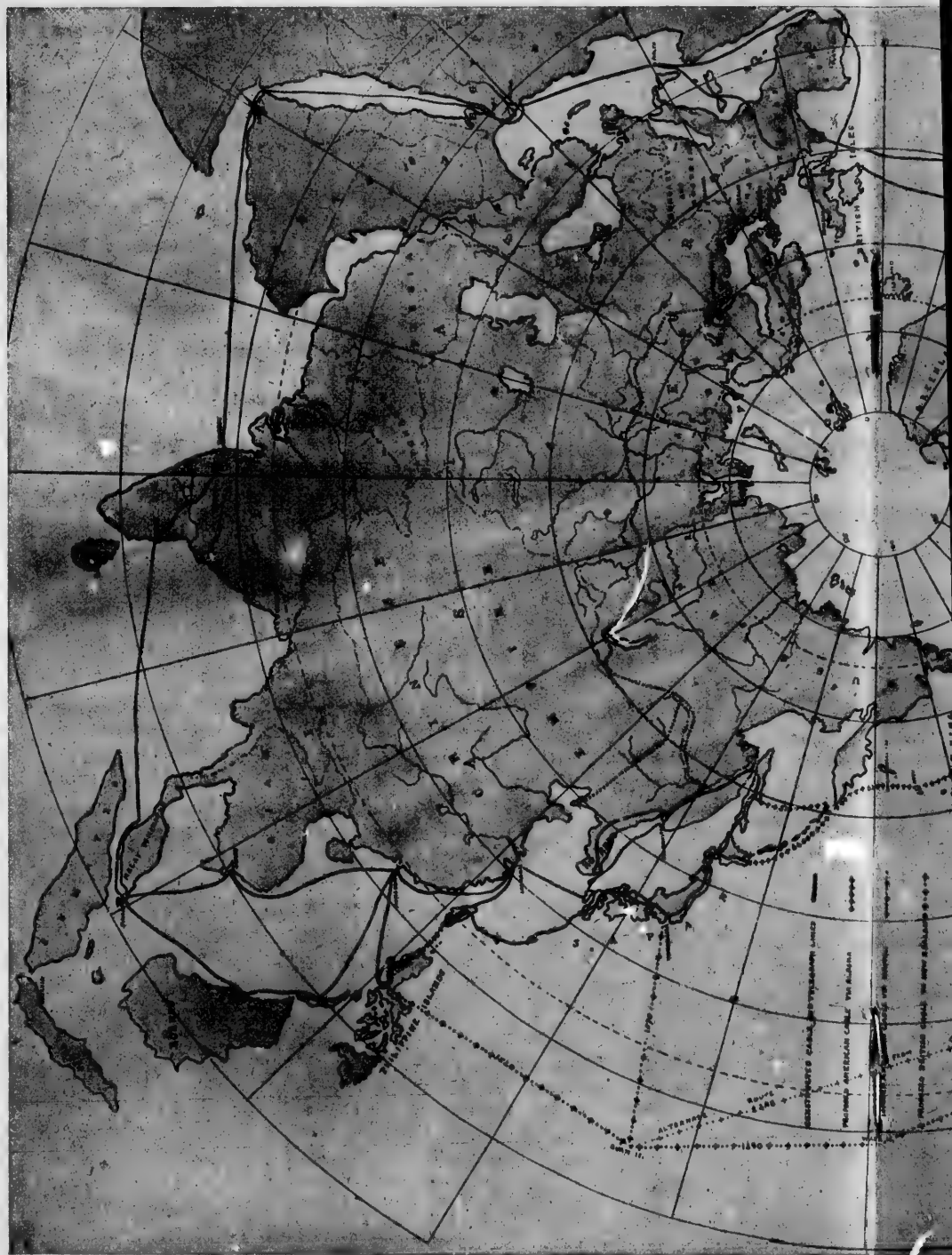
Pacific coast, which is so rapidly growing in importance, runs through Dutch Harbor in Alaska, touches Attu, the last of the Aleutian islands, and until recently the most westward possession of the United States, crosses in short links to the Russian-Japanese boundary, with one branch to connect with the existing Siberian net-work of land lines, and the other branch to run down through Japan (Yokohama being on the circle), and onwards to the Philippines, looping, on its way from Attu to Manila, the whole of the rich Asiatic coast to North America.

The Proposed American-Pacific Cables.

A legitimate cable enterprise across the Pacific is not one depending on government subsidies as the only protection against bankruptcy, but one in which commercial and government business will pay both maintenance and interest.

A glance at the map or at the photographs of the globe show that the point furthest north and west in the United States is the nearest to the Philippine Islands, nearest even to Singapore, thirteen hundred miles further south; and that China, Korea, Japan and Eastern Siberia lie along the short line, all nearer the United States than Manila. This short course also touches the Alaskan Islands four times at intervals of 800 miles. The distance from Cape Flattery to Dutch Harbor is 1,590 nauts. To Japanese wires 3,685, to the Philippine Islands 5,468 nauts. From California to Japan via Dutch Harbor the distance is only 3,850 nauts, but from San Francisco via Hawaii and Guam it is 2,090 nauts to Honolulu, 7,095 to Yokohama, 7,075 to the Philippine Islands. The northern route to Japan is, therefore, 3,410 nauts shorter from Cape Flattery, 3,275 shorter from California, *or only half as long* as the southern route.

The northern cable route bends slightly to the north of the ideal short line in order to pass through Sitka, the capital of Alaska, and in order to follow all the way to Dutch Harbor the slope of the coast and thus avoid extreme depths, and any depth approved could be selected, from 500 to 2,000 fathoms, but one thousand fathoms has been chosen as most suitable. The bottom is favorable, being sand and gravel. Four stations are made in Alaska—at Sitka, on Kadiak Island, at Dutch Harbor and on Attu, the last of the Aleutian Islands, which is only 640 nauts from the Japanese-Russian boundary, where the cable is divided. One branch, 810 nauts, runs south outside the Kurile Islands to junction with the Japanese land wires, and the other branch runs due west 617 nauts to junction with Russian wires. In this manner connection is effected with the whole of Asia by two different routes, making interruption impossible beyond the boundary and





insuring the neutrality of one route in case the United States were at war with either country. A short American line will connect the Philippine Islands with Formosa so that messages from the United States will touch but one foreign country, Japan, and if Japan should be unfriendly, they can be sent via Russia and China.

If Russia and Japan should be at war with each other, there is no good reason why either should cut the American-Asiatic cable, landing at their boundary, but if the cable, on this account, should be temporarily damaged, communication still remains open between the United States and Asia by way of Europe.

The greatest stretch on the northern cable route is 858 nauts, from Attu to the boundary, and this could be reduced to half the distance by a station on the Commander Islands. The sea is also deepest here, at one place 2,154 fathoms. These figures of the depth and length should be compared with the corresponding longest link of 2,639 nauts between Midway Island and Guam with the astounding and fatal depth of 4900 fathoms, only to be avoided by a long detour. The other links of the Alaskan cable are all very close to 800 nauts in length.

Cape Flattery to Sitka.....	803
Sitka to Kadiak Island	682
Kadiak to Dutch Harbor.....	770
Dutch Harbor to Attu.....	810
Attu to Japan-Russian border.....	858
Border to Japanese wires	810
Border to Siberian wires	617
Formosa to Philippines.....	200

Total5,550

The cable lengths on the Southern route are:

San Francisco to Honolulu.....	2,403
Honolulu to Midway Island.....	1,311
Midway Island to Guam.....	2,639
Guam to Yokohama.....	1,805
Guam to Manila.....	1,784

Total9,942

The uniformity on the northern line is of very great advantage, as it necessitates but one type of deep-sea cable, one set of laying and repairing machinery, and a comparatively small cable steamer, stationed permanently at Dutch Harbor, midway on the line and able to reach any break in four days and to relay an entire link in six days, the broken stretch being repaired when convenient and forming part of a duplicate line.

The Hawaiian line requires four different types of cable, and two repair ships will also be needed, one at each end of the route, as there is no suitable midway station, Midway Island, a little coral reef, being just twice as far from either end as Dutch Harbor from the terminals of the Alaskan cable. No cable repair ship on the southern line could be equipped with sufficient length of cable to relay a broken link, and the only repair possible is to find, grapple the cable and cut out the flaw, an operation of almost insuperable difficulty in depths surpassing those in which any cable has ever been laid, much less repaired.

A repair steamer, the best that could be sent from the near-by ports of Europe, was several *months* repairing the break already alluded to in the French cable. A total loss of the longest link on the northern line means less than \$500,000. The loss of the longest link on the southern line means nearly \$4,000,000.

Owing to the short links, 107 lbs. of copper will transmit eighty-five five-letter words a minute. The southern cable, with 500 lbs. of copper, will transmit at best forty words a minute. The light northern cable, therefore, not only can be laid for one-third the cost, but it will be twice as efficient and less liable to interruption. For construction, maintenance and efficiency the Alaskan coast route is, in fact, more favorable than any long-distance cable route in the world.

Cable locations are not selected to please the engineer or the manufacturer of cables, but for commercial reasons and, however ideal, unless this route is commercially better than rival routes, it must be condemned. Happily, it is commercially as superior to the others as it is geographically, mechanically and electrically.

Revenue and Business

A cable receives revenue from four sources: It has way stations, it connects terminals, it forms a link for world traffic, it serves the government, and all contribute to its support.

LOCAL BUSINESS.

It is not unimportant for the United States to be in close connection with a possession 600,000 square miles in extent, nearest neighbor to Canada, with friction all along the border, nearest neighbor to Russia, with impending friction all along the border. Alaska has 60,000 miles of surveyed cod fish banks, great salmon and halibut fisheries, while its fur seals have been an interminable subject of international negotiation. It is now peopled with 30,000 American miners and their followers, who annually send some \$20,000,000 in gold to the United States; for, geographically, Dawson is part of Alaska, and its miners, with few exceptions Ameri-

cans, can only go there or return by way of Alaskan ports. Over 30,000 men went to Alaska in 1898; 10,000 returned, and 15,000 went in in 1899, and it is probable that 30,000 will go in in 1900. Such a country and such a population require cable connection with the central government and home people.

From the first station, Sitka, the capital of Alaska, a short branch is proposed to Juneau (with the greatest quartz gold mine on the Pacific slope), and to Skagway, the entry port for the whole upper Yukon valley and the terminus of the White Pass Railroad, (which will earn its whole cost over the pass in its first year of operation.) This railroad is now doing a telegraph business of nearly \$100 a day, the messages being forwarded between Skagway and the nearest telegraph stations in the United States by steamer, a five-day delay. Last winter Dawson was cut off from communication with the outside world for four months, and fifteen to twenty days were required to make the trip to the coast. The inevitable delays and extreme slowness in winter travel, as well as the magnitude of the interests involved, will make Skagway one of the best cable stations in the world.

The second station, on Kadiak Island, near Copper River (with its independent all-American mail route to the Yukon over the new trail, with its rich coal mines and petroleum wells, with its fisheries and canneries), will also prove, in time, a valuable station. Sitka and Kadiak Island are in the latitude of Edinburgh, Scotland, and possess as mild a climate, in which cattle and sheep winter without shelter on the luxuriant native grasses.

The third station is Dutch Harbor,* the central port of the North Pacific. Dutch Harbor is nearer San Francisco than Honolulu, is nearer Honolulu than San Francisco, as near Guam as Honolulu. It is the great port of entry or the lower Yukon. Forty to fifty steamers have anchored there in a single month, and 2,000 south-bound miners passed through there in October, 1899. It is estimated that 20,000 miners will pass north through Dutch Harbor in 1899 to the Cape Nome and Cape York gold fields.

Dutch Harbor, not as far north as Sitka or Kadiak, is in the latitude of Liverpool, and has a similar climate. The winters are also far less severe than those of Chicago or New York, and if it belonged to England it would become, as it deserves, the great and impregnable naval station, the Halifax of the North Pacific.

With Dutch Harbor local business ends, sufficient, however, to warrant the construction of a cable thus far without reference to Asia.

*See comparative maps inside title page.

What local promise is there on the southern line to compare with this? At Hawaii business is concentrated in a few hands; at Midway or Wake Island* and at Guam there is **NOTHING** It is for this reason that even a Hawaiian cable cannot be laid without a subsidy, although the project has been advocated for more than ten years.

In 1895 Mr. Jas. J. Scrymser, president of the Pacific Cable Company of New York, said: "Cable communication between the United States and the Hawaiian Islands is of great importance to both, **ALTHOUGH THE LENGTH OF SAID CABLE, THE GREAT DEPTHS AT WHICH IT MUST BE LAID AND THE SMALL AMOUNT OF BUSINESS IN SIGHT RENDER IT IMPOSSIBLE FOR ANY CORPORATION TO PROFITABLY LAY SUCH A LINE UNLESS GOVERNMENT ASSISTANCE IS OBTAINED.**

BUSINESS BETWEEN TERMINALS.

See Map.

For both north and south routes the terminals are the United States and the Philippine Islands. Along the northern route lie Japan, Siberia, Korea, China, before Manila is reached. On the southern route *nothing*, and Asia is entered backwards via Manila. This has an important bearing on rates. With a charge of one dollar

*Wake Island is a very small uninhabited coral reef thus described by Chas. Wilkes, U. S. N., who visited it in 1841: "Wake Island is a low coral one of triangular form, eight feet above surface. There is no fresh water on the island, and neither pandanus nor cocoanut trees. The rise and fall of the tide was three feet. From appearances the island must be at times submerged or the sea makes a complete break over it; the appearance of the coral blocks and of all the vegetation leads to the conclusion, showing also that the violent winds or rush of the water when the island is covered are from the westward."

Wilkes' survey of this island was corrected in 1898, with the remark that the island is from five to fifteen feet above high tide, with the rise of tide about six feet. The last reports on the island are dated January 17, 1899, on which date observations were made by the U. S. S. Bennington, with the following remarks: "No anchorage. Entrance to lagoon closed. Island is in some places twenty feet above water. Nothing was seen to indicate that the sea breaks over it." In view of the fact that the barometric wave is eight feet, that the tidal wave following earthquakes is often forty feet, that storm waves in those vast reaches of the Pacific may be very high—it seems impossible that this island should not be frequently submerged, and while it has been suggested that a high tower could be built in which to land the cable and in which the cable operator might find refuge, the same authority also insists that a ship should visit the island every few months and replace the employees, who by that time would probably be insane and playing havoc with the messages.

a word to Manila over the northern route, the toll to Japan should not exceed 75 cents a word, but with a dollar toll to Manila over the southern route a message back to Japan or Russia would cost \$1.25. Where the southern route could not afford a toll of less than one dollar with a subsidy, the northern line can earn more in proportion with toll of 25 cents without a subsidy.

WORLD BUSINESS.

The messages between North America and Eastern Asia, however many, are but a small fraction of the European cablegrams to and from Asia.

The map shows the Alaskan cable to be a link in a route from London to Yokohama, 2,400 nauts shorter than eastwards via India, but the Hawaiian route is 1,000 nauts longer than via India. The Alaskan route, with a world's business of its own in and out of the Yukon gold fields, deriving a sure support from this source of revenue alone, can compel the European-Asiatic traffic to come its way, because it can reduce through rates beyond the ability of its European rivals to compete. The Hawaiian route, not only longer, but with no local or world's business of its own, must depend for revenue on through business, and, as it must charge all the traffic will bear, owing to the high first cost of the line, it will be in no position to fight for business.

THE COST OF CABLES.

The materials used are copper, gutta percha or India rubber, hemp or jute and steel sheathing wire. The price of all is now high, more than twice as high as when Charles Bright made his estimate of £250 as a fair price per naut for an Atlantic cable not laid.

The requirements for the cables are approximately:

	Northern Route.	Southern Route.
Copper	107 lbs.	510 lbs.
Gutta percha		325 lbs.
India rubber.....	101 lbs	
Compound, jute and tanned hemp..	726 lbs.	1,146 lbs.
Steel wire	1,102 lbs.	3,000 lbs.
Total weight	2,036 lbs	5,481 lbs.

With copper wire at 20c, gutta percha at \$1.75, rubber at \$1.50, tanned jute at 10c and best steel wire at 10c, the cost for material alone on the northern line is \$356.40; on the southern line, \$1,176.

To the price of materials must be added cost and profit in manufacture and expense in laying. An addition of 50 per cent.

for this purpose is not sufficient, but whatever the figure it will apply proportionately to the two lines, as the shorter links, the more favorable depths, the closeness to coaling and other stations, are all in favor of the northern line.

The miles of cable required for the northern route, with all its branches, is closely 5,750 nauts, while on the southern route the cable required is closely 10,000 nauts.

The northern line, with materials costing but one-third as much, and in length but little more than half as long, can be as readily laid for \$3,000,000 as the southern line for four times that amount, or \$12,000,000.

Estimates based on the reports before the British Cable Commission make the fixed annual charge for interest, sinking fund and maintenance on the northern line \$376,000; the cost of operation \$120,000. On the southern line fixed charges approximate \$1,500,000, and operation \$110,000.

A rate per word and a volume of business that would make the northern route a successful commercial enterprise, would have to be multiplied by three to keep the southern company out of a receivership.

DUPLICATION.

The President of the Pacific Cable Company of New York, Mr. Scrymser, thus writes of duplication:

“All the leading cable companies have found it absolutely essential for their permanent commercial success to duplicate their lines. In this way only can uninterrupted communication be secured, for, with one cable broken, the other cable can work while the first is being repaired. Applying this principle to the proposed Japanese cable, it must within a short time of its construction be duplicated by the laying of a second cable.”

To duplicate the southern route means to double its cost, and it must be laid between the same stations, as there is no other southern route. This will require 10,000 miles of additional heavy cable.

On the northern route an important part of the initial plan is to lay a double cable from Cape Lopatka and Choumchoum Island westwards and southwards, as has already been indicated, insuring both neutrality and duplication beyond these stations, one Japanese, the other Russian.

When full duplication shall be required to reach Cape Lopatka from the United States it will call for about 4,000 nauts of additional line, and it need not follow the same route, as it could be advantageously laid along the inside passage with stations in British Columbia, at Mary's Island and Wrangle, Alaska, touching

Yakutat Bay, Copper River, Cook's Inlet and other of the Alen-tian Islands than Unalaska (Dutch Harbor), touching also the Commander Islands between Attu and Kamschatka, and finally landing at the Russian harbor of Petropaulowiski. This duplicate cable need have no stretch over 400 miles, and would be essentially a high and cheap cost cable.

Or a duplicate northern line could be laid on the great circle directly from Cape Flattery to Chirikof Island in one stretch of 1311 cable nauts, a distance exactly equal to the shortest link on the southern route but in water not so deep.

The southern line via Hawaii duplicated would cost between \$24,000,000 and \$36,000,000, which is prohibitive. The northern line can run by two routes with different stations, which is better than duplication, for a total of \$5,000,000 to \$6,000,000.

THE ALL-BRITISH CABLE.

The proposed British cable from Vancouver to New Zealand may be dismissed with brief consideration. It is not an American line, nor will it foster American trade with Asia. It is everything that a cable should not be; it has all the objectionable features from which the Alaskan cable is free.

It does not lie along trade routes; it cannot be laid or operated without subsidies; it has the longest span ever proposed; it will lie in the deepest water, through coral and volcanic islands; it cannot be protected in time of war, and it is easiest destroyed and almost impossible to repair.

It is only because it lies so far away from financial centers that a glamor of romance can be thrown around it.

It has no promise of local business between stations, because however rich and prosperous the colonies of British Columbia and New Zealand, both lie in the temperate zone, both are mountainous, sea-girt, sparsely settled and the chief wealth consists in fisheries, lumber, mines and agriculture.

It has no promise of through business, because New Zealand and Australia are nearer London eastwards than via Vancouver.

The links proposed are Vancouver to Fanning Island 3561, to Figi 2093, to Norfolk Island 967, to New Zealand 531, to Australia 834, a total of 7,986 miles.

A competent British commission has made an exhaustive and most valuable report on the route of this *ALL-BRITISH* girdle around the earth. Other considerations than those of cost, length, depth, must have weighed in determining the selection of the route Vancouver, Fanning Island, Norfolk Island. A cable starting from the extreme north of Queen Charlotte's Island, British Co-

lumbia, thence by sundry islands in the Pacific to British Papua, and across or around it to the North Cape of Australia would have followed a thousand mile shorter route and reduced the longest link by five hundred miles.

AN OVERLAND LINE.

An overland line has been proposed via the Yukon river, across Bering Sea and down the Russian coast. This is the old Western Union Route, projected in 1864, when it was considered impossible to maintain an Atlantic cable. This route, from Skagway to the Siberian coast, has been carefully re-examined by expeditions under charge of the writer during the last two years. At Plover Bay, Siberia, are still to be seen the remains of one of the Western Union stations, and the stumps of telegraph poles. The depth of Bering Straits is between twenty-four and twenty-eight fathoms, and it is often packed full of ice early in September. After the fullest investigation the project of an overland line to Asia was abandoned because, while such a line might be made useful for local needs, it is not suitable as a link in what will be the great and direct telegraphic highway between Europe and Eastern Asia. Northern land wires are interrupted in winter for days, if not weeks, at a time, paralyzed often by magnetic storms, and no repairs of cable plowed up by ice could be effected in Bering Sea from October until June. An overland wire is in operation to Dawson from Skagway, and the Canadian government has a project to build a land wire from the Canadian Pacific north to connect with the Dawson line. If this should be carried out, this land line could be used to Sitka in case of any temporary interruption of the first section of the Alaskan coast cable.

A Canadian Line to the Yukon

The fact that Canada proposes to have an exclusive wire to her possessions along the Canadian Alaskan border is an additional and very important reason why there should also be an American line of communication. No other nation is attempting to dispute our title to the Hawaiian Islands, but every foot of ground is being contested in the Panhandle of Alaska, hostile military posts being stationed all along the border, which on many occasions have pushed forward into and occupied what has long been held to be American territory.

WHICH ROUTE SHALL BE SELECTED.

A great commercial enterprise is incompatible with a narrow nationalism. If the western coast of North America is to reap the Asiatic harvest, ready for the gathering, a direct Pacific cable must be laid to Asia, as business cannot successfully be transacted either

via London or via Australia. Canada is fully conscious of her imperial position between the two great oceans of the world—between the two great marts eastward and westward. The United States is slowly awakening to the importance of its position as paramount power in the Pacific, and it should not long permit this last ocean to remain unspanned. Here is a great world market at its western door, opening a hungry mouth for food and clamoring for manufactures, both of which North America so abundantly and splendidly produces. In spite of their misunderstanding over the Alaskan frontier, Canada and the United States are jointly interested in laying the shortest and best cable to the Oriental world, forcing European messages and European trade to come this way, through the Golden Gate to San Francisco, through the great Columbia River to Portland, through the San Juan de Fuca Straits, to a cluster of American-British cities—Seattle, Tacoma, Victoria, Vancouver.

It is not an impracticable and ruinous subsidized cable, whether British or American, that is needed, but a cable constructed on sound financial principles, along a commercial highway, and a feasible route, that will bind closer in friendship and in swelling trade relations the United States, Canada and Great Britain of the west—Russia, Japan, China and tropical Asia in the east.

Appendix I.

THE TWO PACIFIC CABLE ROUTES.

- A. Alaskan Coast Route from Cape Flattery via Dutch Harbor and Attu.
 - B. Hawaiian Route from nearest point in United States via Hawaii and Guam.
-
- A. Shortest distance via Alaska to Philippines.....5,468 nauts
 - B. Shortest distance via Hawaii and Guam to
 Philippine Islands7,095 nauts
 In favor of A.....1,527 nauts
-
- A. Shortest distance via Alaska to Japanese wires....3,685 nauts
 - B. Shortest distance via Hawaii and Guam to
 Japanese wires7,111 nauts
 In favor of A.....3,426 nauts

- A. Shortest distance via Alaska to Siberian wires.....3,540
- B. Shortest distance via Hawaii to Siberian wires7,710
- In favor of A.....4,170

- A. Shortest distance via Alaska to China5,490
- B. Shortest distance via Hawaii and Guam to China.....7,195
- In favor of A1,705

- A. Shortest distance via Alaska to Singapore6,718
- B. Shortest distance via Hawaii to Singapore8,090
- In favor of A1,372

- A. Shortest distance via Alaska to Australia.....6,360
- B. Shortest distance via Hawaii and Guam to Australia....6,860
- In favor of A 500

- A. Total cable required via Alaskan coast to connect
with Siberia, Japan and Manila5,550 nauts
- B. Total cable required via Hawaii and Guam to connect
with Manila and Japan9,942 nauts
- In favor of A.....4,382 nauts

- A. Shortest links in cable via Alaska..... 858 810
- B. Shortest links in cable via Hawaii2,639 2,403
- In favor of A.....1,781 1,593

- A. Average to maximum sea depth.....9,000 to 13,200 feet
- B. Average to maximum sea depth.....15,000 to 29,400 feet
- In favor of Alaskan route.....6,000 to 16,400 feet

- A. Copper per mile on 800 naut stretches.....107 lbs.
- B. Copper per mile on 2,000 naut stretches500 lbs.
- In favor of Alaskan route393 lbs.

- A. Insulation per mile on 800 naut stretches..100 to 140 lbs.
- B. Insulation per mile on 2,000 naut stretches..350 to 400 lbs.
- In favor of A250 to 260 lbs.

- A. Steel wire per naut of light cable
in 6,000 feet depths1,000 lbs.
- B. Steel wire per naut of heavy cable in
15,000 feet depths3,000 lbs.
- In favor of A.....2,000 lbs.

- A. Total cost per mile laid\$ 500 to \$ 700
- B. Total cost per mile laid\$1,500 to \$1,800
- In favor of A.. ..\$1,000 to \$1,100

- A. Total cost for 5,750 miles\$ 3,000,000 to \$ 5,000,000
- B. Total cost for 10,000 miles\$15,000,000 to \$18,000,000
- In favor of A.... ..\$12,000,000 to \$13,000,000

Owing to the recent phenomenal rise in price of copper, gutta percha, India rubber, hemp and steel, estimates of cost have only relative accuracy.

- A. Speed or capacity in 5-letter words per minute.....85
 B. Speed or capacity in 5-letter words per minute.....45
 In favor of A.40

On links under 800 nauts, but not for greater distances, certain automatic, high-speed recording instruments can be used.

In 1896, when all cable materials were very low in price, Mr. Jas. J. Scrymser, Presidet of the Pacific Cable Company of New York, estimated the cost of a cable to Hawaii only at \$3,250,000. This is for a distance less than one quarter of the whole. For this same link he estimates annual cost of maintenance at a minimum of \$175,000.

Appendix II.

DISTANCES IN NAUTICAL MILES FROM DUTCH HARBOR AND FROM HONOLULU TO VARIOUS POINTS IN THE NORTH PACIFIC AND ELSEWHERE.

See Hemispheres Front Page.

Distances in nautical miles.

Dutch Harbor to	Honolulu to	Dutch Harbor nearer by
San Francisco.....2,040	San Francisco2,090	50
Cape Flattey.....1,590	Cape Flattey.....2,310	720
Philippine Islands...3,879	Philippine Islands...5,005	1,126
Guam.....3,330	Guam3,330	
Japan via Attu.....2,095	Japan via Guam5,021	2,926
Shanghai via Attu and Japan.....3,690	Shanghai via Guam and Japan..6,020	2,330
Hongkong.....4,350	Hongkong5,575	1,225
Vladivostok.....2,635	Vladivostock.. ..6,100	3,465
Singapore.....5,128	Singapore.6,006	878
Australia.....4,770	Australia..4,870	100

Dutch Harbor commands Bering Sea and is close to the Pribilof Seal islands, to St. Michaels, Cape Nome and Cape York, the newest and richest gold fields in Alaska; it is in the vicinity of good coal mines, and it can be reachhed from the United States by an inside protected passage through which the voyage has been successfully made by Indian canoes and frail river boats.

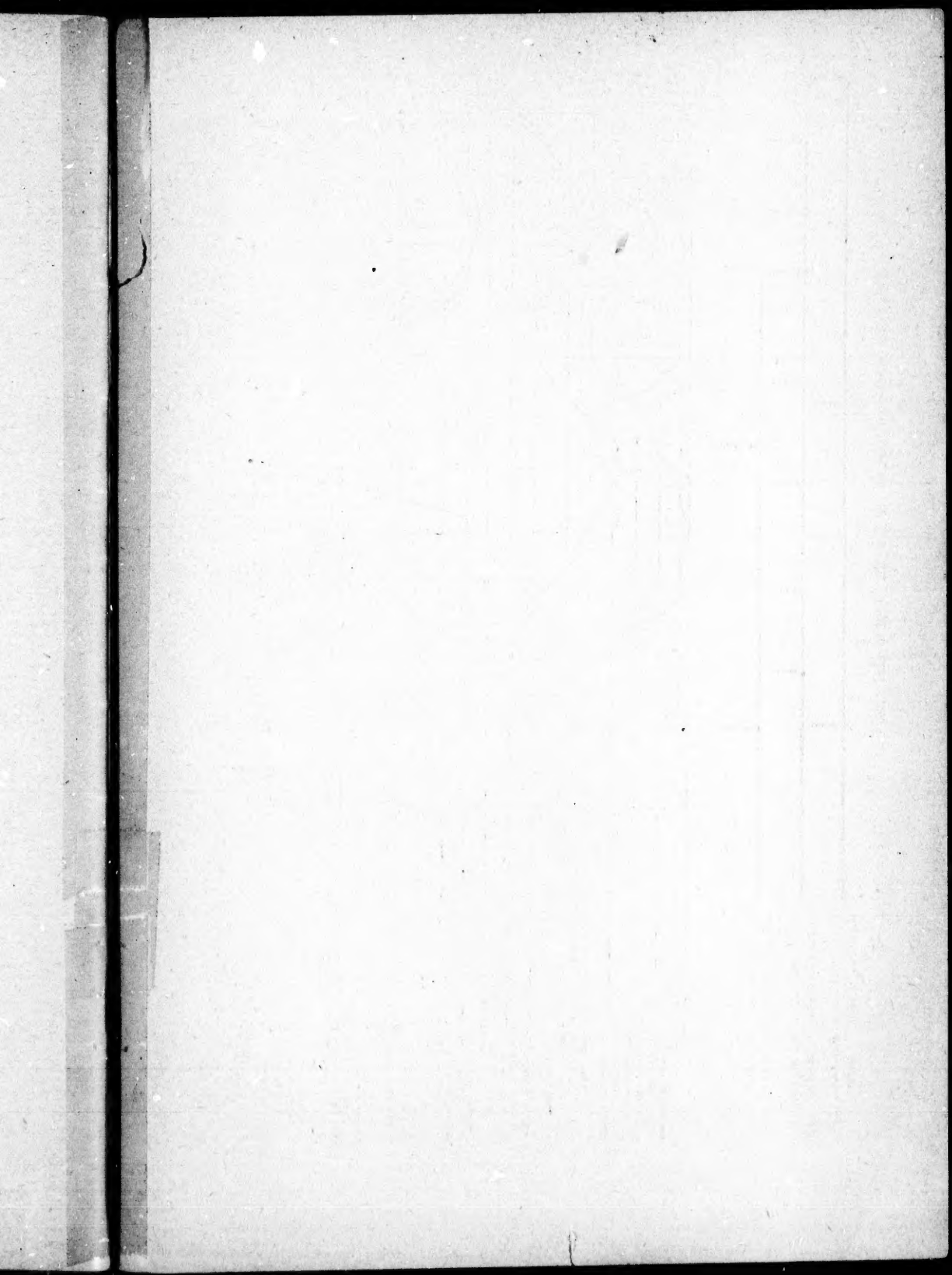


Diagram showing comparative lengths, depths and spans of proposed Pacific cables.

